

# SYRIANA

 *(While I have been trying to find a resolution to MI's DNC delegation in the last few days, the Admin put on their nukes in Syria dog and pony show. Partly because I didn't have the time to do the Syria presentation justice, and partly because Professor Foland—whom you know from his great comments—has a lot more expertise on this area than I, I asked him to do a post assessing the presentation. Thanks for the really informative post, Prof! -ew)*

If there's one thing I've learned over the course of this Administration, it's that if Dana Perino one day announces that the sky is blue, I will be forced to assume that an alien invasion has commenced with the total ionization of Earth's upper atmosphere.

With that in mind, there's an awful lot of cognitive dissonance for me in analyzing the evidence on the raid (apparently named "Operation Orchard" by the Israelis) on a Syrian desert site (apparently named "Al-Kibar"). Having started my own blog motivated by "the incredible amount of lies & hyperbole on the Iran situation of early 2006", I don't find it easy to accept anything this Administration puts forth as evidence. I'm having all this difficulty because the pictures they showed last Thursday are clearly pictures of a nuclear reactor.

In what follows, I will lay out the history of what we've known about Operation Orchard and al-Kibar, what the latest photographs show, and what questions we should probably be asking.

A little bit about what I know. My training is in the experimental science of particle and nuclear physics; post-moniker-choice I left academia for more recent experience in applied device engineering in the field. This means I am not a detailed expert on the engineering design of nuclear reactors or weapons, but I do have

basic familiarity with the field. I'm not an image analyst, so I'm not going to comment very much on whether the shadows in the pictures all line up the way they should. (Of course, if something very technically wrong appeared in the pictures, I'd certainly be posting "zOMG those aren't dilithium crystals!".)

It should also be said that any sort of technical look at the images and videos presupposes that the images are what they are purported to be—taken on the ground at the site in Syria. I'll return to the question towards the end; but in the meantime, for the sake of argument the provenance is granted.

Finally, I'm trying to be careful to distinguish evidence that is conclusive from evidence or reasoning that is suggestive or even powerful. I do have an opinion on whether this was part of a weapons program; but I don't feel my opinion was compelled by the available evidence.

What We Knew Before Thursday

1. Israeli jets flew over Syria on Sept. 6 ("Operation Orchard")
2. Syria lodged no particularly strong protests
3. No radioactivity was released as a result of the overflight (I could find no news stories to this effect—but that's precisely the point. Within a few hours of Chernobyl, radioactivity readings were going nuts in Europe.)
4. There was a 47 meter x 47 meter x 24 meter structure ("Box on the Euphrates") erected a few hundred meters

from the Euphrates River at 35d42m28s(N), 39d49m59s(E).

5. This structure was destroyed between August and October
6. A new building, 60 meters x 60 meters x 15 meters was erected on top of the old site between October and January
7. An apparent water-treatment facility 5 km to the northeast was built prior to August, and connected by pipe to the rebuilt site after October
8. American intelligence had noticed the buildup at the site in 2003 but did not conclude it was threatening.
9. American officials were exchanging intelligence with Israel in advance of the Sept. 6 strike

Note I'm trying here to be as precise as possible about what was known. For instance, it's pretty clear that 1,4, and 5, taken together, add up to "Israeli jets destroyed the structure." But the site coordinates given here were (highly informed and ultimately correct) speculation on the part of the folks at the independent institute ISIS, who spent many hours in the yeoman's work of poring over 2000 square kilometers of satellite images to find the likely site of (4). Neither the US, Israel, nor Syria ever provided or confirmed the location of the site before Thursday.

I'm being careful about this because for a while there was considerable confusion about the location of the strike. There are two other

largish buildings and an airfield in the vicinity; and there have been reports that the Israeli jets also overflew Turkish airspace. (According to Defensetech, the Turkish border is where Syrian air defenses were weaker, and Israeli jets chose to enter Syrian airspace there.) There were early reports of a strike on an agricultural phosphorus facility or even a port facility; and even speculation that the raid had strick nothing or had failed in its mission.

#### What The Video Shows

The CIA briefing video now clearly confirms the ISIS location; the imagery there is of the same canyon. The "Box on the Euphrates" is in fact "Al-Kibar". The animated video segments are virtual reality; they are relatively accurate concerning the local geography (a canyon off of the Euphrates) and size of the building, but they are a model and should not be taken as primary evidence in any way.

Here was the question posed in the comments at armscontrolwonk back on October 26, 2007:

Finally, let's assume for a minute that there was a large , round, reinforced concrete cylinder inside that building. Are there any alternatives for such a facility besides a reactor?

Nobody produced an alternative. Note that the pressures on the interior of the reactor vessel are equivalent to a water depth of about 400 m.

There are four significant stills, all purported to be taken at the Syrian site:

1. A degraded satellite photo taken soon after the raid showing a large circular structure in the center of the building
2. A still taken during

construction, outside and under tarps, of components of what appear to be a steel reactor pressure vessel for a reactor

3. A still taken from inside the main building, showing the rebar structure of a large cylindrical tank. nb swimming pools are made with a single layer of rebar, and even diving wells are only 5 m deep
4. A still taken from inside the main building, showing the rod heads. (Note: the height of the facility must include sufficient headroom for removal of fuel rods and control rods).

Taken together and granting provenance, to me these stills are conclusory: that's what a nuclear reactor looks like. Alternatives must provide a good engineering reason to have a cylindrical multiply-ported steel-lined concrete vessel, at least 16" thick and 5m deep, quadruply reinforced with rebar, topped by a geometrically regular pattern of rod ports.

Some Other Notables from the Video

- A satellite picture showing early structure stages which were later covered by a "curtain wall" that gave rise to the final Box-on-the-Euphrates shape
- A ground-level photo showing the "inside building" under

the curtain wall, looking much like Yongbyon

- A picture showing two people standing for a picture, one of whom also attended US-North Korean Nuclear Talks. Did you hear Mohammed Atta met Czech intelligence?

#### What We Can Reasonably Assume

If the provenance is granted, then it is safe to assume that the Syrians were building, but not yet operating, a nuclear reactor capable of plutonium production at the site of the Box on the Euphrates, and that they have rebuilt a second structure atop the destroyed remains of that reactor. It is safe to assume no radiological traces will be present to damn the Syrians. One may safely assume that absent extremely intrusive IAEA inspections (which I suspect are unlikely), the reactor core components will never be physically recovered. The reactor components are broadly consistent with being a magnox reactor similar to such reactors built by the UK, France, and North Korea. One may also assume that US officials made no substantial attempt to dissuade the Israelis from the strike.

#### Is It A Weapons Program?

So, with the provenance caveat, this was a nuclear program. Was it a research program, an energy program, or a weapons program? The evidence we have to date is that the reactor could have served any of the purposes—remember, it may not have been complete. Magnox designs have in the past been used to produce weaponizable plutonium. They have also been used for research, and for power. Nothing in the presented evidence is conclusive to me, one way or another.

There does not seem to be any hint so far of a plutonium reprocessing facility. If the intent

is to produce plutonium, the uranium fuel rods, after being in the reactor for some time, must be removed. Some of the uranium will have transmuted into plutonium. The rods need to be dissolved, the plutonium removed, then the untransmuted uranium recovered for reinstallation into the reactor. No building has been identified that might serve as a reprocessing center. Magnox reactors in particular have some special problems, so that reprocessing facilities tend to be located nearby.

#### The CIA's Three Conclusions

The CIA video begins and ends with three "key conclusions." The conclusions are in italics, followed by my take.

Syria was building a gas-cooled, graphite-moderated reactor that was nearing operational capability in August 2007. The reactor would have been capable of producing plutonium for nuclear weapons, was not configured to produce electricity, and was ill-suited for research.

If you grant the photo provenance, the construction of a nuclear facility is very well attested by the evidence presented, and certainly consistent with magnox. Magnox designs are gas-cooled and graphite-moderated. I don't know enough to say conclusively that it is consistent solely with a magnox design. The operational capability in August 2007 is a reasonable inference if the only purpose was for plutonium production, but is not specifically attested to by any presented evidence. The facility would have been capable of producing plutonium for a weapon. No evidence presented leapt out to me as "ill-suited for research". The electrical-configuration question is attested by an apparent lack of local power lines, but logically this may be related to the operational capability question. (i.e. perhaps it was an unfinished facility.) Note that the

briefing does *not* present a conclusion that this was for a weapons program—because there's no evidence on that question one way or the other.

The reactor was destroyed in early September 2007 before it was loaded with nuclear fuel or operated

That the site was destroyed before nuclear reactions were initiated is well-attested in the public evidence.

We are convinced, based on a variety of information, that North Korea assisted Syria's covert nuclear activities, both before and after the reactor was destroyed. Only North Korea has built this type of reactor in the past 35 years.

I find this conclusion very weak; nothing presented made this seem any stronger than a simple assertion. It was asserted that there is considerable evidence; none was presented. The North Korean Yongbyon complex is said to be the precursor design for the Syrian al-Kibar reactor. The statement "only North Korea has built this type of reactor in the last 35 years" is a little bit misleading; the time period of 35 years was chosen because 40 years ago the UK built them. In fact the North Korean Yongbyon design is actually copied in turn from a British design (specifically, Calder Hall). The UK still operates several of this magnox design even today. A country with little technical ability and scant resources will find much to like in the magnox design: it requires unenriched uranium, low input power, modest technical requirements (mainly in graphite purification), and relative ease of operation. The design is also very thoroughly described in the literature, being relatively obsolete. Finally, as Cheryl Rofer has noted, the detailed design of the control rod and fuel rod ports is actually different in the photos of al-Kibar than in existing photos of the 25 Mwt reactor at

Yongbyon.

Provenance

If the pictures are of the site, then Syria was building an undeclared nuclear facility. So—were they of the site?

Now we're in the world of shadows, angles, oblique transformations, Photoshop, etc. I can't tell you the answer.

I'll just make a few observations on the subject:

- A number of colleagues have expressed a surprising level of skepticism concerning the provenance. Not specific "for reasons X and Y I think these photos were taken somewhere else", but basic variants of "you've seen how these people operate, why should we believe these photos are real?" This was surprising even to yours truly, who thinks Dana Perino would lie about meteorology.
- A scientific experiment that is gunning for a big result generally leaves a trail of less remarkable results first, which establish that the experiment is capable of measuring other things that it ought to be able to measure and which have been previously established. That's because scientists

expect others to be very skeptical—so they build in a reinforcing chain, back to what's already known, in their arguments from the beginning. In the case at hand, knowing there would be skepticism about the provenance (especially given the history), if I'd been the briefing officer, what would I have done? I would have found and presented a series of photographs that put together a traceable chain of features from the local terrain down into the reactor core. That's because the local terrain is easily independently verified, by commercial satellites and even Russian/Chinese satellites. One way (but not the only way) would be to have a series of photographs from outside, in the door, along the halls, into the main hall. They claim to have a very large volume of photographs of which only a few are shown. *It troubles me nobody thought it important to put together that chain*, because it would have reduced the space of skepticism to "it's a photoshop world". Instead,

there are only a few photos, all tightly cropped. (Source protection seems inane here. The steel liner image, and the interior rebar image, can already likely be dated to within a week or so by the relevant Syrian authorities.)

- To me, the difference wrt the Powell Iraq presentation, is that in that case, a lot of inconclusive images were shown as "illustrations" to go along with bald assertions about what unshown intelligence concluded. Here, the conclusions can be drawn directly from the photos—to the extent they are genuine.
- The satellite still photo, described as still photo #1 in "What the Video Shows", is particularly key to the provenance. I'm willing to bet that airspace (spacespace?) over the al-Kabir sight was crowded with reconnaissance satellites for several weeks after the strike. If the satellite image were flatly inconsistent with, say, Russian images, I imagine the Russians would take

great joy in exposing an American forgery.

- The use of a forgery in making a case for WMD's is not unknown in this administration.

And with those, pass along an observation from a colleague:

We're outsourcing our intelligence-gathering to agencies (e.g., the Israeli government) that clearly have an institutional bias, so we cannot be certain of whether the raw intelligence can be trusted or not. It's bad enough that we cherry-picked intelligence to go to war in Iraq, but we're at risk here of having those cherries picked by others and delivered to us...

There are some convincing satellite images of the cylindrical vessel, and there is generally wide availability of third-party satellite images that could likely falsify what's shown. So given the lack of specific contrary evidence, and despite significant reservations, if you put a gun to my head and said I had to pick, on "preponderance of evidence" I'd go with a genuine provenance. It's not even close to "beyond a reasonable doubt".

IAEA, NPT, and the UN

One of the many tragedies of the Iraq war is that the formation of UNMOVIC in the run-up seemed like a possible model for a more intrusive anti-proliferation regime. Could it have provided a path to a more effective set of additional protocols to the Nuclear Non-Proliferation Treaty (NPT)? We'll never know.

Mohammed El-Baradei has censured the US and Israel for providing their information only now at such a late date. (Please note, he has not censured them for the truth or falsity of the

information.) The IAEA can only barely demand access now to the site; Syria is not going to grant access; and even with access, the relevant evidence has been demolished and buried under a building. Had IAEA been notified instead of scrambling the F-16's, the IAEA might have had a chance to prove its relevance. And a successful proof of relevance would have been good for the world, thought perhaps not for UN-haters centered in Washington, DC. (In fairness, one should also weight that with the possibility of an unsuccessful proof of relevance...)

In the comments on Friday, klynn provided a nice timeline of UN and IAEA related actions since the strike.

The US administration, having been pre-warned by the Israelis, made a policy choice not to notify the IAEA. One can speculate why, but really it's incumbent upon the administration to explain to Americans why they made that choice.

#### Rhetorical Links to Iran

I feel confident that we are going to be hearing a lot more of this sort of thing (Adm. Mike Mullen):

It should serve as a reminder to us all of the very real dangers of proliferation and need to rededicate ourselves to prevent the spread of weapons of mass destruction, particularly into the hands of a state or a group with terrorist connections.

In case that was too subtle for you, the SAO at the CIA press briefing was a little less coy in spelling it out:

SENIOR ADMINISTRATION OFFICIAL:With respect to Iran, the Syrian episode reminds us of the ability of states to obtain nuclear capability covertly and how destabilizing the proliferation of nuclear weapons in the Middle East would be.

(Emphasis mine.) Iran was also mentioned in this briefing as "*potentially interrelated*", "*the same kind of cooperation between North Korea and Iran*", and "*But is there something going on there that resembles this program that we we're talking about in Syrian, in Iran?*" It would be irresponsible not to speculate, don't you think?

In the same Syria briefing, Iran also was mentioned in the context of the declassified NIE:

But our unfortunate choice of words in our NIE caused you all in the press to misrepresent what we were trying to explain. Three parts of the program; they halted one narrow piece of it, which was a secret program – weapons-head design. They continue with fissile material; they continue with ballistic missile systems for delivery. So we don't know where it is at the moment.

(Emphasis mine.) This made me nearly choke on my breakfast. Are they really using this Syria episode to retract the crystal-clear statements in the Iran NIE?

Steinn Sigurdsson at Catdynamics has some thoughts on what the Israeli willingness to strike al-Kibar might signal for the upcoming planned turn-on of the Iranian Arak facility.

Learning More

The original source for much of the information about the al-Kibar site has been the Institute for Science and International Security. There has also been very credible analysis by the posters and commenters at armscontrolwonk, and in a series of posts by Cheryl Rofer at whirledview. There have also been some very interesting threads at moonofalabama, but I simply have not followed the commentary there long enough to have any idea how reliable it is relative to the others I know well. The Federation of American Scientists has a 735-page tome of pretty much every press report, image,

satellite photo, or commentary that has related to the al-Kibar site. The FAS is an outstanding site in general for technical security information. Globalsecurity provided a very complete and credible analysis back in November. And I provide occasional commentary on matters nuclear at my own place, nuclearmangos.

#### Summing Up

The CIA has published pictures that clearly show interior, unplaceable shots of the steel and reinforced concrete components of a nuclear reactor pressure vessel, an interior and unplaceable shot of a nearly completed reactor core, and a placeable satellite image of the damaged al-Kibar structure showing a large round structure in the center of the building. To me it is not conclusive, but more likely than not, that the provenance is genuine and the images indeed show an undeclared nuclear facility at the Syrian site of al-Kibar.

#### Questions We Need To Be Asking

The nuclear situation in the Middle East is going to get more complicated as a result of actions on all sides of this—Syrian, American, and Israeli. American servicemen and women most of all, but all of us ultimately, will surely in the coming months be bearing greater risks than we did before.

- We deserve an answer to why American policy makers made the policy choice to pursue this through means other than the IAEA.
- We deserve an answer to the question what impact bypassing and undermining the IAEA was was expected to have in our difficult situation with respect to Iran.

- Reporters need to be asking "pull on the thread" type questions, even where there's no specific reason for doubt. Some of this went on in the CIA briefing (i.e. "were American capabilities involved in the Sept. 6 raid?") but reading the transcript you can practically hear the reporters turning to one another and saying, "These are not the droids we are looking for."
- We deserve an answer to the question of what national technical means of verification the US can make available to the IAEA to settle the question once and for all should access to the site be gained.
- We deserve to know how, why, and when the first agnostic American assessment of the nature of the site was changed to an assessment that it was a nuclear reactor.
- And finally, we deserve better than having to guess whether these images have an indisputable provenance. Given what's at stake, and the history of our village with wolves, this

administration owes it to us  
to prove it.